



DEFENSE HEALTH BOARD
FIVE SKYLINE PLACE, SUITE 810
5111 LEESBURG PIKE
FALLS CHURCH, VA 22041-3206

AUG 8 2011

FOR: JONATHAN WOODSON, M.D., ASSISTANT SECRETARY OF DEFENSE
(HEALTH AFFAIRS)

SUBJECT: Tactical Evacuation Care Improvements within the Department of Defense
2011-03

INTRODUCTION

1. Tactical Combat Casualty Care (TCCC) is a set of trauma care guidelines customized for use in the pre-hospital combat setting. TCCC is currently used in combat and in training for medics by all Services in the Department of Defense and by many U.S. coalition partners.^{1, 2}
2. The Committee on Tactical Combat Casualty Care (CoTCCC), a work group of the DHB Trauma and Injury Subcommittee, performs a quarterly review of current evidence to evaluate the successes and shortcomings of the current TCCC Guidelines, and considers proposed updates and revisions.^{1, 2}
3. The CoTCCC received briefings from various subject matter experts, including: U.S. Army Institute of Surgical Research representatives^{3, 4, 5}; the Medical Director for Enroute Critical Care Nurses and Medical Evacuation Units Performing Patient Evacuation in Afghanistan;³ a trauma surgeon who had served at a Role III hospital in Kandahar, Afghanistan;⁶ the United Kingdom's Medical Emergency Response Team (MERT);⁷ and U.S. Service representatives to include those from the U.S. Army;⁸ U.S. Marine Corps;⁹ U.S. Army 82nd Airborne Division;¹⁰ U.S. Army 160th Special Operations Aviation Regiment;¹¹ and U.S. Air Force Pararescue (PJ) units.¹² In addition, numerous combat medics with field experience have emphasized the importance of improving tactical evacuation (TACEVAC) training and capabilities to the CoTCCC.^{13, 14, 15}
4. On April 5, 2011, the CoTCCC developed and approved recommendations underlining the need for improvements to current TACEVAC care procedures, and their standardization, where possible, across the Services.
 - a. The DHB Trauma and Injury Subcommittee approved the recommendations by unanimous vote on April 6, 2011.
 - b. The DHB approved these recommendations by unanimous vote in an open session held on June 14, 2011.

BACKGROUND

5. The basis for the civilian helicopter emergency medicine systems (EMS) emerged during the Vietnam War. Although EMS has since evolved into a highly sophisticated mobile pre-hospital care platform, there are opportunities to improve the

care provided to casualties during TACEVAC (from Point of Injury to first Medical Treatment Facility)^{16, 17, 18, 19}

6. U.S. Central Command (USCENTCOM) established the Joint Theater Trauma System (JTTS) in 2005, with the goal of ensuring the delivery of “the right patient to the right place at the right time to receive the right care.”²⁰ Modeled after civilian trauma systems, the JTTS provides leadership and structure to standardize in-theater care, including Clinical Practice Guideline (CPG) oversight.^{20, 21}
 - a. There are currently over 30 CPGs,²¹ and one focused on in-theater evacuation.¹⁶ However, the intratheater transport CPG addresses transport between Medical Treatment Facilities (MTF), and not explicitly from Point of Injury (POI) to MTF.²²
7. Despite substantial advancements in care provided both on the battlefield and during TACEVAC, a lack of standardization in the level and quality of care available to Service members evacuated from theater has resulted from the wide range of platforms with differing capabilities and provider skill sets.^{19, 23}
8. In 2009, the Secretary of Defense mandated that all MEDEVAC missions be completed within 60 minutes.
9. There has been a recent increase in the number of casualties with dismounted complex blast injuries (DCBI) sustained from improvised explosive device (IED) attacks in the Afghanistan Theater of Operations (ATO).^{24, 25} These casualties require an advanced level of care during evacuation to a MTF in order to optimize their chance of survival.²⁴ The Task Force on DCBI, appointed by the U.S. Army Surgeon General, recently emphasized the importance of placing advanced-level medical staff aboard rotary wing evacuation platforms, and endorsed TCCC-recommended TACEVAC care improvements.²⁴

FINDINGS

Platform/Capability

10. Both MEDEVAC and casualty evacuation (CASEVAC) platforms are used in U.S. TACEVAC missions. MEDEVAC platforms carry no offensive weaponry and are marked with a Red Cross. CASEVAC platforms are not dedicated solely to evacuation of casualties, are armed with weapons and armor, and lack the Red Cross marking.^{13, 26}
11. MEDEVAC missions are often not permitted to deploy to an unsecure area with a high risk of encountering hostile fire. When a dedicated MEDEVAC unit is the only platform available and evacuation is needed from a combat zone, a delay in evacuation may result.²⁶

12. Three primary TACEVAC platforms have emerged during the current conflicts. The system is complex, as it involves Joint Service and multinational coordination. The primary platforms are the following:
 - a. U.S. Army UH-60A Blackhawks, also known as DUSTOFF, which includes one Emergency Medical Technician-Basic (EMT-B).¹⁶
 - b. U.S. Air Force Guardian Angel HH-60 Pavehawks, also known as PEDRO, which include two Pararescuemen (PJs). PJs are trained to Emergency Medical Technician-Paramedic (EMT-P) level.¹²
 - c. United Kingdom Medical Emergency Response Teams (MERT) use CH-47 Chinook aircraft and have a TACEVAC care team that includes a critical care transport team consisting of one emergency physician or anesthesiologist, two EMT-Ps, and one emergency nurse.^{7, 27, 28}
13. The MERT platform, when available, is utilized to evacuate the most critical casualties.^{3, 7, 19}
 - a. The MERT platform offers advanced airway management, intravenous medications, and definitive resuscitation with blood and plasma.^{7, 27, 28}
 - b. The MERT platform surpasses U.S. TACEVAC models in both critical care capability and number of providers.^{7, 27, 29}
 - c. The MERT model is capable of providing a higher level of care than either U.S. Army DUSTOFF or U.S. Air Force PEDRO, thus optimizing the casualties' chances for survival when he/she is critically injured.^{7, 27, 29}
 - d. In-theater observations suggest that the MERT is preferentially used to transport the most severe casualties, especially those with DCBI.^{4, 7, 19}
 - e. The CH-47 Chinook used by the MERT is a larger aircraft than the HH-60, thus accommodating a larger support team, a greater number of casualties, more equipment, and more space to provide care to casualties.^{7, 27, 28}
 - f. Published documentation comparing casualty outcomes across the MERT, PEDRO, and DUSTOFF platforms is currently lacking.⁷

Provider Skill Level and Oversight

14. An increasing number of casualties from the current conflicts require advanced level trauma care by experienced, highly-trained providers.^{16, 24, 25, 27, 28, 30}

15. U.S. military medical personnel who supervise combat medical staff, including physicians who support in-theater air ambulance services, do not receive routine TCCC training.^{31, 32} Their training is typically based on civilian trauma courses that may not reflect recent advances in battlefield trauma care.^{19, 31}
 - a. Since 2002, over 40 after action reports from Iraq and Afghanistan have noted that Army flight medic training and skill level is a key issue, and have recommended the implementation of paramedic-level training as a solution.^{16, 19}
 - b. A recent after action report indicated that the lack of advanced flight medic capability was associated with increased mortality.¹⁹
16. U.S. civilian EMS air ambulances are staffed routinely with two-provider medical crews, most often composed of critical care flight paramedics (CCFP), critical care flight nurses (CCFN), or a combination of both.^{16, 17, 19, 23}
 - a. A retrospective cohort study (pending publication) demonstrated that mortality was significantly lower when evacuation was performed by a U.S. Army National Guard Air Ambulance unit with formally trained CCFPs compared to standard military air ambulance units, staffed with EMT-Bs.^{17, 19}
 - i. Nearly two-thirds of the medics in the CCFP study group were EMT-Paramedics with an average of nine years of trauma experience prior to deployment.¹⁷
 - ii. These findings align with previous evidence that trauma training and experience play a critical role in survival outcomes for patients, especially in the instances of polytrauma, airway compromise, ventilatory insufficiency and head injury.^{16, 17, 18, 19}
 - b. Following this study, a review of U.S. Army policy regarding the staffing of TACEVAC platforms with EMT-B trained flight medics resulted in a call for TACEVAC personnel to receive additional training and receive CCFP certification.^{3, 14} This recommendation was recently approved by the Army Surgeon General.¹⁴
17. The MERT provides a staffing model that is better suited for critical casualties.^{7, 27, 29}
 - a. An Urgent Universal Need Statement for a Forward Resuscitation and Evacuation Team (FRT-E) based on the British MERT has been submitted by U.S. Navy physicians supporting U.S. Marine Corps operations in the ATO. The proposed FRT-E would operate from a Marine Corps rotary-wing platform and would deliver more advanced trauma care to wounded marines at or near the POI.²⁷

- b. An analysis of patients evacuated in the ATO during a three-month period in 2009 reveals a rate of unexpected survivors by MERT transport of 14.9 per 100 patients in contrast to a rate of 4.8 per 100 patients during the same time period for U.S. TACEVAC.²⁹
- 18. Flight surgeons within TACEVAC units may not have trauma care experience or training in TCCC. This limits their ability to supervise and train TACEVAC flight medics.^{13, 17, 18, 19, 23}
 - a. Many flight surgeons have not yet completed residency training or may have been trained in specialties that do not provide experience caring for polytrauma patients.^{18, 19}
 - b. Flight surgeons often have little or no training and experience in EMS or in-flight critical care.^{17, 18, 19, 23}
 - c. This differs substantially from civilian helicopter transport systems, in which oversight is often provided by physicians with specific training in pre-hospital and en-route critical care.^{16, 18, 23}
- 19. There are currently no dedicated JTTS personnel assigned to Pre-hospital care cells or within the JTTS structure within CONUS, resulting in a disconnect between TACEVAC coordination and oversight and JTTS.^{3, 19}

Response Time

- 20. Combat trauma deaths occur for the most part in the prehospital phase of care, highlighting the need to optimize care during this period.^{28, 33}
 - a. Advanced provider skill level (above EMT-B level) during transport of the severely wounded improves survival.^{16, 29, 33}
 - b. The Israeli Defense Force (IDF) forward deploys non-surgeon physicians, trained in battlefield medicine during low intensity conflicts. These physicians provide treatment if the evacuation time to the level I trauma center is greater than 30 minutes. Findings from the IDF suggest that there is no benefit in delaying transport to stabilize the patient when the transport time is less than 30 minutes.³³
- 21. Findings from a study of patients received at a combat support hospital suggest that rapid transport be prioritized over field interventions.³⁴
- 22. When casualties are sustained in areas where there is active hostile fire or a significant threat of hostile fire, flying rules may prohibit MEDEVAC aircraft from carrying out the evacuation. A contingency plan in which CASEVAC aircraft may be tasked to evacuate the casualties may enable the evacuation to be accomplished. In

2003, the Special Operations Task Force incorporated this concept, along with modular medical packages that would allow for the rapid transition of an armored, armed rotary wing aircraft, not dedicated to TACEVAC missions, into a temporarily designated CASEVAC transport vehicle.²⁶

Standardization, Documentation Procedures and Quality Assurance

23. Currently, there is no standardized TACEVAC care protocol for DoD.
 - a. There are no uniform treatment protocols, standard operating procedures, or other guidance from commanders or flight surgeons to form a basis for policies. Significant variation in treatment protocols persists between units.^{17, 19, 23}
 - b. This differs from civilian EMS, which operates with standard protocols designed to improve patient care.^{16, 23}
 - c. The JTTS CPG pertaining to intratheater care transport and the TCCC TACEVAC care Guidelines offer some direction for care provision; however, implementation may vary, especially between platforms with differing capabilities.^{6, 5, 19}
24. Observations from deployed Service members suggest that documentation of care during TACEVAC is limited.^{2, 3, 5, 17, 19}
 - a. The lack of documentation from tactical pre-hospital settings hinders quality assurance and improvement efforts. Specifically, a lack of pre-hospital care documentation prevents policymakers from identifying areas where deficiencies exist or substandard care is provided.^{2, 17, 35}
 - b. Prior to December 2010, less than three percent of JTTR records included any documentation of care provided during TACEVAC.^{3, 19}
 - c. TACEVAC documentation is most often completed after patient transfer, and may be received only by the supervising flight surgeon.^{3, 19}
 - d. Documentation of care and trauma registry systems such as the JTTR, unit-based Pre-hospital Trauma Registries, and DoD patient electronic medical records, as well as those used by North Atlantic Treaty Organization (NATO) and the Office of the Armed Forces Medical Examiner are not linked together, and nations are not responsible for providing data to any other database but their own.³
 - e. No systems exist to capture adverse outcomes, protocol violations or sub-standard care outside of individual TACEVAC units. Flight reviews are not currently a requirement of JTTS quality assurance measurements, and documentation is not included in commander unit status reports.^{3, 19}

25. Preliminary results of a pre-hospital interventions study in the ATO and Iraq Theater of Operations suggest that TCCC casualty cards are completed for only 14 percent of casualties. This low rate of return could be due to delays in casualty card receipt among combat support hospitals.⁵

CONCLUSION

26. Significant opportunities for improvement exist in regard to the tactical evacuation phase of combat casualty care. Specific areas of focus should include contingency planning; the choice and staffing of TACEVAC platforms; response time; provider requirements, training, and oversight; and documentation of care.

RECOMMENDATIONS

27. **The Board recommends that the DoD pursue the following recommendations as soon as possible to ensure that combat casualties receive TACEVAC care that will optimize their likelihood of survival:**

Platform/Capability

- a. **Develop an U.S. Advanced TACEVAC Care Capability.**
 - i. **In the near term and on a limited basis, pilot this capability where tactically feasible and where a high probability of critical casualties exists.**
 - a) **Structure capability after the successful MERT model to the extent possible.**
 - b) **Consider an emergency medicine or critical care physician-led team.**
 - c) **Ensure that capability includes current best practices, as indicated in the JTTS CPGs and TCCC TACEVAC Care Guidelines, including fluid resuscitation, advanced airway capabilities, and intravenous medications.**
 - d) **Use this capability when possible for the most critical casualties.**
 - e) **Ensure that trauma care procedures and outcomes are documented comprehensively.**
 - f) **Utilize the most capable platform available (CH-47/CH-53/CV-22).**

- g). Use the outcomes from this pilot effort to inform further tactical evacuation system-wide changes.
- b. Ensure that TACEVAC platforms are staffed with in-flight care providers to meet or exceed the civilian standard. Such platforms should each include at least two of the following providers during critical care casualty transport, and at least one of the following providers per critical casualty:
 - i. Critical care-trained flight paramedic
 - ii. Critical care-trained flight nurse
 - iii. Critical care-capable flight-trained physician
 - iv. Critical care flight-trained certified nurse practitioners or physician assistants
- c. Ensure routine availability of packed red blood cells and plasma on TACEVAC platforms for critical casualties. TCCC Guidelines pertaining to resuscitation should be followed, which include:
 - i. Limiting the amount of crystalloid infused
 - ii. Using hypotensive resuscitation with Hextend® when blood is unavailable.

Provider Skill Level and Oversight

- d. Staff TACEVAC platforms with providers who are trained and experienced in trauma care. Recommended training includes:
 - i. Ongoing intensive care unit/trauma experience
 - ii. Experience at Service trauma training centers
 - iii. Other trauma rotations that provide ongoing trauma patient contact
 - iv. TCCC training
- e. Trauma training should be the primary focus of pre-deployment competencies for individuals who provide trauma care on TACEVAC platforms. Supervising physicians in TACEVAC units should have similar training and experience. Commander unit status reports should convey provider training level information.

- f. In-theater oversight of TACEVAC systems should be provided by a qualified medical officer with EMS experience.
- g. Dedicated personnel should be assigned to Pre-hospital care cells as part of both the deployed JTTS staff, and within the JTTS structure in CONUS.

Response Time

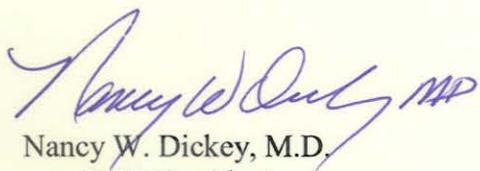
- h. TACEVAC planning should aim to optimize evacuation time for all likely tactical contingencies.
 - i. Define hostile fire evacuation options in mission planning as a supplement to dedicated MEDEVAC platforms.
 - ii. Consider the use of armed, armored CASEVAC aircraft to avoid evacuation delays due to ground fire.
 - iii. Consider the use of modular medical packages for deployment on tactical aircraft designated to perform TACEVAC duties.

Standardization, Documentation Procedures and Quality Assurance

- i. Standardized TACEVAC care capability should be a Joint requirement.
- j. Standard Protocols for TACEVAC care, as outlined in the TACEVAC section of the TCCC Guidelines, should be accepted across the Services as the standard of care during in-theater evacuation.
- k. Improve TACEVAC care documentation procedures and implement process improvement measures.
 - i. Collect TCCC cards from ground medics and analyze data.
 - ii. Gather NATO cards for flight portion and analyze data.
 - iii. Ensure reliable entry into Joint Theater Trauma Registry (JTTR) and on the casualties' Electronic Medical Record (EMR).
 - iv. Enhance prehospital data fields in the JTTR.
 - v. Integrate data collection between the JTTR, EMR systems, unit-based Pre-hospital Trauma Registry and the Office of the Armed Forces Medical Examiner.
 - vi. Include flight care documentation in Commander unit status report.

- vii. Incorporate flight reviews of TACEVAC care in JTTS quality assurance measures.
 - viii. Conduct a follow-up when no pre-hospital data is provided for a casualty.
28. The above recommendations were unanimously approved.

FOR THE DEFENSE HEALTH BOARD:



Nancy W. Dickey, M.D.,
DHB President



Donald Jenkins, M.D.
Chair, Trauma and Injury Subcommittee



Frank K. Butler, M.D.
Chair, Committee on Tactical
Combat Casualty Care
(at the time of the vote)

WORKS CITED

1. Butler FK, Giebner SD, McSwain N and Pons P, eds. *Prehospital Trauma Life Support Manual: Military Version*. 7th ed. St. Louis: Mosby; 2010.
2. Eastridge BJ, Mabry RL, Blackbourne LH and Butler FK. We Don't Know What We Don't Know: Prehospital Data in Combat Casualty Care. *The United States Army Medical Department Journal* 2011; April-June: 11-14.
3. Presentation: JTTS TACEVAC Overview, to the Committee on Tactical Combat Casualty Care, by LTC Robert Mabry and MAJ Rich Morton, April 5, 2011.
4. Presentation: Tactical Evacuation Skills Level and Outcomes, to the DHB Committee on Tactical Combat Casualty Care, by LTC Robert Mabry, November 17, 2010.
5. Presentation: USAISR Prehospital Interventions Study, to the DHB Committee on Tactical Combat Casualty Care, by Maj Julio Lairet, November 16, 2010.
6. Presentation: TCCC from the Level III, to the DHB Committee on Tactical Combat Casualty Care, by LCDR Chris Burns, February 8, 2011.
7. Presentation: Medical Emergency Response Team (MERT), to the DHB Committee on Tactical Combat Casualty Care, by Lt Col Rob Russell, April 5, 2011.
8. Presentation: U.S. Army TACEVAC Overview, to the Committee on Tactical Combat Casualty Care, by SFC George Hildebrandt, April 5, 2011.
9. Presentation: CASEVAC in the Marine Corps, to the Committee on Tactical Combat Casualty Care, by CDR William Padgett, April 5, 2011.
10. Presentation: MEDEVAC in the 82nd Airborne Division, to the Committee on Tactical Combat Casualty Care, by CPT Carl Kusbit, April 5, 2011.
11. Presentation: TACEVAC in the 160th Special Operations Aviation Regiment, to the Committee on Tactical Combat Casualty Care, by CPT Kyle Faudree and SFC John Dobbins, April 5, 2011.
12. Presentation: Air Force Personnel Recovery, to the Committee on Tactical Combat Casualty Care, by Dr. John Gandy and CMSgt Anthony Negron, April 6, 2011.
13. Presentation: Tactical Evacuation Discussion, to the Defense Health Board, by Dr. Frank Butler, June 14, 2011.

14. Presentation: TACEVAC Issues, to the Trauma and Injury Subcommittee, by Dr. Frank Butler, April 6, 2011.
15. Presentation: TACEVAC Issues, to the Committee on Tactical Combat Casualty Care, by Dr. Frank Butler, April 5, 2011.
16. Mabry RL and De Lorenzo RA. Sharpening the Edge: Paramedic Training for Flight Medics. *The United States Army Medical Department Journal* 2010; April-June: 92-100.
17. Mabry R, Apodaca A, Penrod J, Orman J and Gerhardt R. Impact of Critical Care Trained Flight Paramedics on Casualty Survival during Helicopter Evacuation in the Current War in Afghanistan. Submitted for publication.
18. Mabry RL and De Lorenzo RA. Improving Role I Battlefield Casualty Care from Point of Injury to Surgery. *The United States Army Medical Department Journal* 2010; April-June: 87-91.
19. Memorandum, United States Central Command Joint Theater Trauma System, After Action Report for MEDCOM Tasker 1039.01C, February 7, 2011.
20. Bridges E and Biever K. Joint Combat Casualty Research Team and Joint Theater Trauma System. *American Association of Critical-Care Nurses: Advanced Critical Care* 2010; 21(3):260-76.
21. Presentation: Observations on Prehospital Trauma Care from the Deployed Director of the JTTS, to the Committee on Tactical Combat Casualty Care, by LTC Marty Schreiber, November 16, 2010.
22. Intratheater Transfer and Transport of Level II and III Critical Care Trauma Patients, Joint Theater Trauma System Clinical Practice Guideline, November 19, 2008, U.S. Army Institute of Surgical Research.
23. Gerhardt RT, McGhee JS, Cloonan C, Pfaff JA and DeLorenzo RA. U.S. Army MEDEVAC in the New Millennium: A Medical Perspective. *Aviation, Space, and Environmental Medicine* 2001; 72(77); 59-64.
24. Presentation: Devastating Dismounted IED Injuries in OEF, to the Defense Health Board, by Dr. John Holcomb, March 8, 2011.
25. Caravalho J. Task Force on Dismounted Complex Blast Injury Report, Executive Summary. April 28, 2011.

26. Tactical Evacuation Care: Instructor Guide, Tactical Combat Casualty Care Curriculum. Updated February 2010, Committee on Tactical Combat Casualty Care.
27. Urgent Universal Need Statement: Forward Resuscitation and Evacuation Team, Capt Nathan L. Robinson, submitted to Commanding General, Marine Corps Combat Development Command.
28. Calderbank P, Woolley T, Mercer S, Schrager J, Kazel M, Bree S and Bowley DM. Doctor on Board? What is the Optimal Skill-Mix in Military Pre-Hospital Care? *Emergency Medicine Journal* 2010; [Epub ahead of print].
29. Clarke JE and Davis PR. Medical Evacuation and Triage of Combat Casualties in Helmand, Afghanistan. Submitted for publication.
30. Kelly JF, Ritenhour AE, McLaughlin DF, Bagg KA, Apodaca AN, Mallak CT, Pearse L, Lawnick MM, Champion HR, Wade CE and Holcomb JB. Injury Severity and Causes of Death from Operation Iraqi Freedom and Operation Enduring Freedom: 2003-2004 Versus 2006. *Journal of Trauma, Injury, Infection, and Critical Care* 2008; **64**(2): S21-S27.
31. Memorandum, Defense Health Board, Tactical Combat Casualty Care Training for Deploying Personnel, June 14, 2011.
32. Memorandum, Defense Health Board, Tactical Combat Casualty Care and Minimizing Preventable Fatalities in Combat, August 6, 2009.
33. Remick KN, Dickerson JA, Nessen SC, Rush RM and Beilman GJ. Transforming US Army Trauma Care: An Evidence-Based Review of the Trauma Literature. *The United States Army Medical Department Journal* 2010; July-Sept: 4-21.
34. Martin M, Oh J, Currier H, Tai N, Beekley A, Eckert M and Holcomb J. An Analysis of In-Hospital Deaths at a Modern Combat Support Hospital. *Journal of Trauma, Injury, Infection and Critical Care* 2009; **66**(4): S51-S61.
35. Hodgetts TJ and Mahoney PF. Military Pre-hospital Care: Why is it Different? *Journal of the Royal Army Medical Corps* 2009; **155**(1): 4-8.